

DOCUMENT RESUME

ED 234 035

SP 022 967

AUTHOR Reifschneider, Thomas J., Ed.; And Others
TITLE The Human Brain: Cognition in Education. Report of the First Annual Conference (Brookings, South Dakota, September 24-25, 1932).
INSTITUTION Educational Environments, Inc., Eugene, Oreg.
SPONS AGENCY Phi Delta Kappa, Bloomington, Ind.
PUB DATE Sep 82
NOTE 94p.
PUB TYPE Collected Works - Conference Proceedings (021) -- Viewpoints (120)
EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Cerebral Dominance; Cognitive Development; *Cognitive Style; Computer Literacy; Creative Thinking; Elementary Secondary Education; Learning Plateaus; *Learning Processes; *Learning Theories; *Neurological Organization; *Perceptual Development; Spatial Ability

ABSTRACT

The papers in this monograph were presented at the first annual conference on theories and research related to learning styles, hemisphericity, and other cognitive-related issues in education. They include: (1) "The Microcomputer and Learning Theory" (Carl Edeburn); (2) "Poems Take Two Brains (or: Poetry Ain't for Halfwits)" (Jack Kreitzer); (3) "Poetry Observations" (Jack Kreitzer); (4) "How the Brain Works: The Proster Theory of Learning" (Thomas J. Reifschneider); (5) "The Structure of Intellect: Overview, Uses, and Implications" (Robert S. Ristow); (6) "Learning Spurts and Plateaus" (Bob Rose); (7) "Left Brain/ Right Brain: More of the Same?" (Gary Steinley); (8) "Cultural Differences in the Classroom as Manifested in Cognition and Non-Verbal Communication" (Ronnie D. Theisz); and (9) "Individualizing Learning Styles--Dunn Model" (Lois Widvey). (JD)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED234035

Report of
the First Annual Conference

THE HUMAN BRAIN:
COGNITION IN EDUCATION

South Dakota State University
Brookings, South Dakota
September 24-25, 1982

Edited by:

Thomas J. Reifschneider
Robert S. Ristow
Gary Steinley

Division of Education
South Dakota State University

Acknowledgement is made to Phi Delta Kappa,
Area 4 for a grant that made the publication
and dissemination of this report possible.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

- ☐ This document has been reproduced as
received from the person or organization
originating it.
- ☒ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Robert S. Ristow

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Table of Contents

INTRODUCTION	1
THE MICROCOMPUTER AND LEARNING THEORY Carl Edeburn	3
POEMS TAKE TWO BRAINS (OR: POETRY AIN'T FOR HALFWITS) Jack Kreitzer	6
POETRY OBSERVATIONS Jack Kreitzer	12
HOW THE BRAIN WORKS: THE PROSTER THEORY OF LEARNING Thomas J. Reifschneider	16
THE STRUCTURE OF INTELLECT: OVERVIEW, USES, AND IMPLICATIONS Robert S. Ristow	26
LEARNING SPURTS AND PLATEAUS Bob Rose	45
LEFT BRAIN/RIGHT BRAIN: MORE OF THE SAME? Gary Steinley	50
CULTURAL DIFFERENCES IN THE CLASSROOM AS MANIFESTED IN COGNITION AND NON-VERBAL COMMUNICATION Ronnie D. Theisz	58
INDIVIDUALIZING LEARNING STYLES--DUNN MODEL Lois Widvey	72
APPENDIX A	82
APPENDIX B	84

In late spring of 1982, several members of the Division of Education at South Dakota State University were discussing theories and research related to learning styles, hemisphericity and other cognitive-related issues in education. It was decided that it would be worthwhile to hold a conference to familiarize elementary and secondary teachers and administrators with these issues. The conference, which was to be titled "The Human Brain: Cognition in Education," was planned for the fall of 1982.

The conference was held on the campus of South Dakota State University in Brookings, South Dakota on September 24 and 25, 1982. The intended audience was composed of teachers and administrators from elementary and secondary schools across the state of South Dakota. Attempts were made to inform this audience of the conference. Due to the short planning time involved and the lack of experience on the part of the coordinators, the publicity about the event was not as effective as it might have been. Nevertheless, there were approximately 70 participants in attendance.

Financial support for the conference was provided by the South Dakota State University Division of Education (\$2,000.00), South Dakota Division of Elementary and Secondary Education (Section for Special Education--\$400.00, Curriculum and Instruction--\$1,600.00), as well as the money from Phi Delta Kappa, Area IV to pay for the publication and dissemination of this report. This monetary assistance made it possible to bring in various presentors from South Dakota and Minnesota. Several

staff members from South Dakota State University also donated their time as consultants and presenters at the conference. For a listing of all topics which were presented, see Appendix A. Originally, plans were to have each topic presented twice, with one session being primarily for teachers and the other primarily for administrators. However, because few administrators attended the conference, this plan was abandoned and the presentations were simply repeated to allow greater access by participants.

Through informal feedback both during the conference and subsequent to it, participants expressed a high degree of satisfaction with the meeting. They reported that the major goal of the conference, to raise their level of awareness with regard to issues of cognition in education, had been met. They also expressed the belief that the next step which was necessary was to provide more information about how to apply this knowledge in the classroom. A more formal evaluation form completed at the conclusion of the two-day meeting also showed a very positive response to the conference. Based at least in part on this feedback, it was decided to make the conference an annual event and plans for the second meeting began shortly after the first meeting ended.

At the time of the conference, each presenter was invited to submit his or her presentation in written form to be included in this report. The remainder of this document is made up of those papers that were submitted.

THE MICROCOMPUTER AND LEARNING THEORY

Carl Edeburn
Professor of Education
South Dakota State University

The term computer literacy has been used by many different people in many different ways. The present writer has identified the description presented by Ruth Walker (1980) as being most compatible with his personal philosophy.

Walker defined computer literacy as containing five elements. These were:

1. A familiarity with hardware and software systems.
2. A knowledge of applications.
3. The effects of computers on society and culture.
4. An awareness of computer-related career potentialities.
5. The development of computer-related problem solving skills.

This list of five is perceived to be quite adequate in regard to the public in general. It is, however, this writer's position that educators need to go beyond this level of awareness, adding two more dimensions as follows:

6. The place of computers and computer instruction in the curriculum.
7. Educational soundness in regard to methodology, learning style and learning theory.

The last dimension was addressed in the present sessions. The particular focus was placed upon learning theory.

Two sessions were conducted using the following format.

1. A discussion and review of SR and Cognitive Theory was elicited.
2. The participants were allowed to interact with a drill and practice software package.
3. A discussion followed in which the instructor elicited examples of the activity which were obvious principles of SR Theory such as repetition, reinforcement, generalization and discrimination.
4. A short discussion of the appropriate SR classroom applications followed.
5. The participants were allowed to interact with a conceptual software package.
6. The discussion that followed was involved with dimensions of cognitive-field theory (perception, figure-ground relationships, interrelatedness, organization and individual life space) that were evidenced in the interaction.
7. A short discussion of appropriate classroom applications of cognitive-field theory followed.
8. Finally, both theories were compared and contrasted, and the participants were charged with the responsibility of identifying such components in their future activities with microcomputer software.

It should be noted that the vast majority of extant software is of the SR variety and teachers who do not necessarily use this

approach in their regular teaching may be able to use it to their students' benefit. Other teachers may object to SR software and elect to select or create programs that are involved with the cognitive-field approach to learning.

The presenter hoped that the experience would expand the cognitive-field (life space) of the participants to include this type of awareness process in their selection and or creation of software.

Reference

Walker, R. Computer literacy: Important--but exactly what is it? Science Digest, 1980, 88 (3), 74-77.

POEMS TAKE TWO BRAINS
(or: POETRY AIN'T FOR HALFWITS)

Jack Kreitzer
Black Hills Special Services Cooperative
Deadwood, South Dakota

1. Description: Sessions will describe the critical importance of the research on right/left brain hemispheres, both for creating poetry, and for motivating gifted students. A simple, guaranteed, two-step method using both hemispheres will be demonstrated for inducing poetry and creative writing with all children and adults. Both educational justifications and practical applications are backed up with handouts, references, resources, and questions and answers. Poetry is underscored as a brain expander, and as an affective therapy.
 - A. The presenter is a former medical student (left brain) become published poet (right brain) who is an educational consultant (emotional doctor) with gifted education, arts with the handicapped, and the writers-in-the-schools.
2. Sperry's Splitbrain studies show the almost schizophrenic, ying-yang, Siamese twin, Jekyll and Hyde nature of the human brain. The dichotomous split of opposite functions for each cerebral hemisphere has huge import for educational planning. Levy has shown that public schools (through the use of reading, writing, and arithmetic

solely) actively stamp out right brain functions, which may account for some of education's inadequacy. Avenues to integrate the education of both brains must be developed and encouraged. The Arts are not luxuries, they are part of the "basic skills."

3. Many persons from Einstein to Rubenzer have shown too that the combined functions of both brains at once in the corpus collosum through the "invention mode" or "Janusian thought", is the root of great creative leaps forward, whether in arts, inventions, physics, gourmet cooking, advertising, or any other field. This fusing of opposites into new wholes is the seat and source through "synergy" of inspiration and of metaphors.
4. Poem-making is an extremely critical component of the educational program of every child, given that degree of intelligence and degree of creativity are not interrelated, as Torrance and others have shown.
5. This is particularly true for children exhibiting gifted behavior, blending great ability (whether academic, intellectual, creative thinking, performing arts, or leadership) with creativity through task commitment resulting in products.
6. These gifted individuals (and all persons) need poetry, in order to have an avenue of emotional release in coping with the social handicaps of their giftedness (journals) to have an outlet for creativity and divergency,

to develop their own critical value system, and especially to be able to use the higher thinking skills of Bloom's Taxonomy while using both the right and left hemispheres of the brain (and both together in the "inventive mode" of Rubenzer).

7. Daily practice in poetry-creating (and in music-making, drama, art, dance, and P.E.) necessitates an individual's use of analysis, synthesis, and evaluation as well as their use of both hemispheres of the brain. Standard public school curricula emphasize lower thinking skills (knowledge, comprehension, application) and focus on left brain skills.
8. This repeated utilization of poetry increases the capability and potential of neural synapses in the brain, an especially crucial fact in view of the limited percentage of cerebral potential believed to be actually used. Just using left functions halves the small brain power available.
9. These right-brain and combined-brain abilities are dampened and sometimes lost without specific training or curricular activities for creativity and affective expression.
10. Administrators and teachers need to recognize these abilities, as well as implications from learning modalities, aesthetic models of programming, the midbrain dampening chemicals resulting from boredom (Dr. Barbara

Clark), the spurts and plateaus in brain growth, and cultural differences that can make learning more effective.

11. Journal writing and poem making are options for meeting most of these needs.
12. In making a poem, the writer first uses his left hemisphere (without judging) to analyze. She/he is being analytical, verbal, semantic descriptive, symbolic, abstract, sequential, rational, logical, and lineal. Similes are created for what the topic is "like" via comparisons.
13. The poet is being convergent, intellectual, conscious directed, propositional, objective, successive, controlled, reality-oriented, active, and sharply focused.
14. When a poet is using analysis, his/her subject is being taken apart, filled in, recombined, differentiated, divided, isolated, ordered, separated, distinguished, dissected, subtracted, related, associated, and patterned.
15. Next the poet uses his/her right hemisphere to synthesize. She/he is making metaphors by relating the descriptors to totally opposite concepts in order to create a new whole. "There were too many people, it was a sea of faces."
16. The poet is being nonverbal, synthetic, concrete, analogic, nontemporal, nonrational, spatial, relational, intuitive, insightful, and holistic.

17. This right-brain and combined-brain "Janusian thought" process creates new concepts metaphorically.
18. The writer is being divergent, free, imaginative, non-linear, multiple, subjective, simultaneous, subconscious, imagic, tacit, emotive, affect-laden, fantastic, receptive, diffuse, sensuous, experiential, associational, tolerant, ambiguous, and nonjudgmental.
19. When a poet uses synthesis, his/her subject is being compared, contrasted, translated, extended, reconstructed, renamed, reorganized, regrouped, restated, systematized, symbolized, varied, modified, substituted, altered, reconnected, minimized, maximized.
20. Finally the writer uses the left brain again to be judgmental and evaluative in editing. Adaptations are made by value judgments and by further synthetic expressions, seeing things for the first time with P.O.E.T. eyes.
21. When a poet is using evaluation, his/her subject is being interpreted, judged, justified, criticized, solved, decided upon, inferred, verified, and concluded.
22. This highest thinking skill, evaluation, is critical to gifted (and all) children for several reasons. Individuals need to be evaluative and unique and independent; they do that by evaluating rules, (the Germans didn't), one's own expressions (editing), the expressions of others (be one's own critic), peer group pressures

(cliches and boredom), television (commercial vs. quality, popular vs. best), and especially to be evaluative of careers, to be the best they can be, not just what someone else wants them to be.

POETRY OBSERVATIONS

Jack Kreitzer

*POETRY HAS NO RULES, NO BOUNDS.

There is NO right or wrong, only good and better.

No expectations means no failure. (NOT "teacher art" or "gallery art".)

Increased self-worth, self-confidence; less peer group pressure (P.G.P.).

Interpretations of art: BE YOUR OWN CRITIC: Evaluative Thinking.
Higher levels of Bloom's Taxonomy:
Analysis, Synthesis, Evaluation.

*ONLY RULE: DON'T RHYME.

Rhyme and Structure reflect individual insecurity at wanted one's LIFE to rhyme; Life does not come out even.

Rhyme first is teaching the highest forms of the art first (along with structures and rhythm, i.e., iambic pentameter), before the basic skills are acquired. Teaching the slam dunk before the dribble.

*GUTS OF POETRY: BASIC SKILLS

WORDS PLUS IMAGINATION PLUS FEELING

EXCITING LANGUAGE PLUS EMOTIONAL WRITING

Rest is incidental and ancillary to making the good better:
Rhyme, Rhythm, Titles, Length, Spelling, Capitalization,
Literary devices, Punctuation, etc.

*EXCITING LANGUAGE

IMAGIC: Full of Images

DIVERGENT THINKING

The unexpected, the unpredictable, the anti-cliche: a fresh perspective.

Seven-Up bubbles tickling the cerebral cortex from the inside.

Words as bucking broncos, hang gliders, time machines, verbal photos.

"DIFFERENT IS OKAY" undoes P.G.P. LYING IN SCHOOL IS OKAY.
THRU ARTS.

Comparisons, associations, similes, metaphors:
unexpected associations, unobvious comparisons, unusuality
in images.

JANUSIAN THINKING: opposites related (synthesized) to a new
whole.

Seeing things for the first time; writing it as a Postcard
Home to Mars.

Wonder from the Ordinary. Startling.

"Compressed Conflicts"

BRAINSTORMING, FREE ASSOCIATION, CREATIVE PROBLEM SOLVING

*EMOTIONAL WRITING

Creativity is Emotional Therapy, Self-Preventative Medicine.

Mode for anyone, but especially adolescents to make Catharsis
Equal Creation; Affective Education for dealing with
emotions and appropriately expressing feelings in a non-
destructive manner.

POSITIVE PSYCHOSIS

SUBLIMATION

A Release without having to Escape.

BE YOUR OWN PSYCHIATRIST: PAPER as a blank paper couch, safety
valve, salve, ointment (precludes treatment costs later)

EMPATH (EMPATHY) - HUMAN: Don't fear feelings.

BALANCE AFFECTIVE EDUCATION WITH COGNITIVE AND PHYSICAL LEVY
research on Public Schools and Right Brain-Affective education.

RESOURCES FOR COPING

*WHY

BECAUSE YOU HAVE TO; IT IS FUN; IT BOILS OUT ON ITS OWN;
TO FEEL BETTER; TO EXPLAIN HOW YOU THINK OR FEEL; MAKE
OTHERS THINK OR FEEL SAME.

TO SERVE AS TIME MACHINE;

A VERBAL PHOTOGRAPH OR TAPE RECORDING OF PEAKS AND VALLEY OF
LIFE WORDS AS MEMORY

SLICES OF LIFE FROZEN

*POETRY AS "WHAT*MAN*CAN*BE"

IMAGINATION, INSPIRATION, DARE, DREAM, WONDER, STAY ALWAYS
YOUNG

HARD TO DO: To dive into the deepest part of yourself (on
demand) and bring up slices-of-heart papers to pass around.
It is shared, but private; takes a risk to reveal.
Especially with inadequate tools of WORDS.
Shared Privates.

*POETRY AS LANGUAGE EXTENSION: Stretch the language with new
words or new ways of describing.

FORMS OF COMMUNICATION * FORMS OF LOVE * FORMS OF UNALONENESS

Mother Teresa, India. Nobel Winner: Worst disease on Planet
is LONELINESS.

*Poetry (and the Arts) are the MOST BASIC: Kids bring with them
imagination, wonder, and a desire to be doing;

They also are the MOST ADVANCED: Highest achievements and
only thing (music) of interest to whales.

Words, Symbols, Abstractions, Imagic Relationships

*POETRY IS WHATEVER MAKES YOU THINK, OR FEEL, OR MOVES YOU OR
LEAVES YOU NOT THE SAME AFTERWARDS (even non-verbal poetry).

UNDEFINABLE

*POETRY (and Music) utilizes BOTH right and left brain hemispheres simultaneously.

Activation of larger percentage of brain power; increased synapses.

*CREATIVITY

Critical component of Gifted individuals, along with Ability, and Task Commitment.

Increase Creative Writing by involving Creativity's components: Fluency, Flexibility, Originality, Elaboration.

BE YOUR OWN T.V. OR MOVIE!

NEW ANSWERS ... CREATIVE PROBLEM SOLVING

*THE ARTS AND POETRY are the Least Restrictive Environment, and can be used as Learning Modalities to teach traditional curricula in an alternate way.

*IT'S NOT THE PRODUCT, IT'S THE PROCESS.

HOW THE BRAIN WORKS:
THE PROSTER THEORY OF LEARNING

Thomas J. Reifschneider
Associate Professor of Education
South Dakota State University

The title may sound a little presumptuous, but it is taken from the title of the book by Leslie Hart (1975)* in which he outlines his theory of learning. The theory does indeed attempt to explain the process of learning by hypothesizing "how the brain works." Ideas put forth by Hart as to the functions of the human brain are based very heavily on the structure of the brain and the presumed evolutionary processes which have shaped that organ.

The pattern which the brain followed as it evolved is divided by Hart into three basic steps. The earliest "true" brains were mainly occupied with controlling movement. The major function of the brain was to direct locomotion. The second stage of brain development centered on a transition in the functioning of the brain which emphasized "species wisdom." That is, the behavior which the brain was most concerned with was more complex than simple locomotion, but now included what would generally be called instinctive behavior patterns and emotional reactions such as "fight or flight" behavior.

*To simplify references; all references to Hart, unless otherwise specified, will be Hart (1975).

According to Hart, the modern human brain is little concerned with species wisdom since most human behavior is learned after birth. The survival value of this evolutionary development of the human brain centers on homo sapiens' need to adapt to a changing environment. Thus, rigid instinctive behavior patterns had to give way to the ability to change behavior to suit the surrounding world.

We come now to one of the basic principles of Hart's theory. That is, that since the human brain evolved for the purpose of adapting behavior to the changing environment (read learning), then learning is exactly what it will do. This leads Hart to conclude that it is meaningless to talk of an individual being motivated to learn, just as it is meaningless to talk of a fish being motivated to swim. Hart says that learning in humans is not something that can be turned off or on, it is a process that goes on continuously. He bases this conclusion on the premise that if a species develops an organ that has a particular function, it will be put to use. He cites, as an example, the elephant's trunk. The trunk is a rather bizarre alternative to the ability, which most animals possess, to bring the mouth and nose to ground level. He asks whether it would make sense to inquire if an elephant will use its trunk. The human brain is analogous to the elephant's trunk in that it is a bizarre adaptation. Hart holds that because the human brain is capable of learning, it will be used for that purpose.

It is interesting to note that not all evolutionary theorists would agree totally with Hart's conclusion regarding the relationship between use and function. For example, Gould (1980) points out that an organ may evolve for a specific "purpose," but may then be used for other purposes. Nevertheless, Hart's argument would appear to have at least some logical validity.

Paralleling the three stage development of the human brain is the concept of a triune, or three-part brain. Hart adopts this concept from MacLean (1978). The oldest part of the brain is the brain stem, which Hart labels the "reptilian brain." Behavior controlled by the reptilian brain is considered to be rigid, stereotyped behavior; but characterized by very quick reaction times. The next part of the brain to evolve was the limbic system or what Hart calls the "old mammalian brain." This portion of the brain grew around the reptilian brain rather than replacing it. (An example of the conservative nature of evolution according to Hart.) The old mammalian brain controls emotional behavior; behavior more complex, but slower than the behavior controlled by the reptilian brain.

Finally developing around the old mammalian brain was the neo-cortex, or as Hart refers to it, the "new mammalian brain." It is this part of the brain that makes up the bulk of the human brain and controls the higher order processes such as thinking, problem solving, and the majority of learning. It is this

highly developed portion of the brain that so dominates human behavior and learning according to Hart. While the new mammalian brain is capable of infinitely more complex processes than the earlier developed portions of the brain, it does so at considerable sacrifice in speed.

In discussing the actual process of learning, Hart (1975, 1978) refers to the acquisition of programs. He takes care to point out that he is not equating the brain with a computer. He says that a program is simply a fixed sequence of events or rather instructions for events. Thus, a computer program fits the definition, but so does the sequence of instructions built into a toaster. Learning, then, is the acquisition of sets of instructions which the brain implements.

Any behavior, ranging from simple reflex behavior to complex problem solving, can be considered to be the result of a two step process; selecting a program and putting that program into effect. Once a program is begun, it will run its course unless something happens to interrupt it. The program may be a very routine sequence that requires no conscious effort; for example, walking down a sidewalk. Or, the program may be one that does require conscious effort; such as making a complicated decision about whether to accept a job offer for a new position. According to Hart, programs that require attention may only be carried out one at a time. However, many programs may be operating simultaneously if they are of an "automatic" nature. For instance, in the above mentioned examples, a person may be walking down the

sidewalk and thinking about the job offer. A program that is operating below the conscious level will be brought to the conscious level if it aborted, that is, if it is interrupted. If the person who is walking down the sidewalk suddenly trips on an obstruction, the walking program is immediately brought to the forefront and the program involved with considering the job offer is temporarily halted. This has obvious survival value.

Hart does not see programs being organized in a random fashion, but feels that related or similar programs are organized as sets. These sets or clusters of programs are labeled "program structures." It is a shortening of this phrase which gives the theory its name. These program structures are referred to as "prosters." A proster is a set of related programs along with a selection device which determines which program will be put into effect in a given situation. The selection device would, in most cases of complex behavior, also be a program. However, for simple behaviors, the selection device may be based on a simple reaction to external stimuli. Any factor which influences the selection of a particular program from a proster is called a "bias." Biases may be external stimuli, internal states of need, attitudes, mental set, other programs, etc.

Hart sees the relationship among prosters as being a heirarchical organization. Thus, prosters are linked to one another so that the operation of a particular program may influence the selection device of another proster which in turn puts another program into effect and so on. This arrangement can account for

the chaining together of various kinds of responses. Given that every individual has a unique heirarchy of prosters, it can also account for individual differences in "associations." For example, one person may associate a particular song with some individual while that same song does not elicit memories of that individual for someone else.

Simplification is one of the advantages of this theory. One does not have to account for a whole variety of mechanisms for handling recognition, cognitive learning, affective learning, skill learning, feeling, memory, concept formation, etc. One basic mechanism, the development of programs which are organized into prosters, accounts for all of these.

Two additional considerations are important in the theory; one relating to the concept of the triune brain, and the other relating to the brain's ability to operate more than one program at a time. Hart states that whenever a person is put in a threatening situation, there will tend to be a shift in the portion of the brain which is in control. If the new mammalian brain is controlling behavior (the majority of the time in humans), a threat will shift control to one of the lower portions of the brain. The reason for this shift is that the programs controlled by the old mammalian brain and the reptilian brain are simpler but faster. This, Hart concludes is a survival mechanism.

The second concept, mentioned above, has to do with thinking. Hart says there are two types of thinking. One type he calls SSM (for symbol selection and manipulation) thinking. This type

of thinking corresponds to the traditional, logical, step-by-step, sequential type of thinking. Programs involving SSM thinking must be done at the conscious level and can therefore be done only one at a time. The second type of thinking, which Hart labels PAC (for perception - analysis - choice) thinking, he refers to as "natural thinking." This type of thinking is carried out at a level which does not require conscious attention and thus there is no need to restrict the number or programs of this nature which can be operated simultaneously. This results in fantastic capabilities and is one of the things that sets the human brain distinctly apart from current computers. PAC thinking can explain why sometimes when an individual has given up on a problem that seems insoluble (by the use of SSM methods) the solution may suddenly "pop" into mind. Hart sees a strong relationship between PAC or "natural" thinking and the creative process.

The basics of Proster Theory can be summarized with the following six principles:

1. Unity -- The brain has only one basic organizational form--programs, in prosters, in heirarchies.
2. Availability -- The brain can only function to the extent that programs have been developed.
3. Foundation -- All programs must be built upon existing programs.
4. Connection -- Sudden increases in mental capacity occur

when links are established between two proster networks not previously linked.

5. Change -- Variation in program selection can be effected: (a) by changing bias, and (b) by causing abortion.
6. Threat -- In proportion to perceived threat, downshifting to faster, simpler, and more primitive brain function occurs (Hart, 1975, pp. 176-180).

One comment needs to be made before discussing the educational implications of Proster Theory. On reading articles and the book by Hart (1975, 1978, 1981), one gets the distinct impression that he has an "axe to grind" with regard to American schools. It seems that he has developed his theory of learning for the specific purpose of showing what a poor job the schools are doing. He describes the schools as an "assault on the brain." However, it is this author's opinion that regardless of Hart's motivation in devising his theory of learning, the theory stands on its own and appears to have merit.

Hart's (1975, 1981) suggestions for improving education are, of course, based upon his conceptualization of how the brain works. He says that becoming educated is not acquiring knowledge, but is, rather, acquiring personally useful programs--emphasis on personally! He describes the brain as an aggressive organ which is constantly seeking fresh input and variety. He also points out that the typical classroom is not structured to encourage this. He also makes much of the idea of the brain downshifting under threat and describes the high level of threat

which he considers to exist in classrooms. His suggestions include attempts to counter these two basic "problems" of the classroom. (In a criticism of Hart's conclusions, Hardyck (1981) brings up the interesting point that it seems difficult to imagine a classroom being simultaneously boring and threatening.)

Some of Hart's key points for improving the schools are summarized as follows:

1. Freedom from threat: an absence of threat is necessary to avoid the downshifting which results in a loss of functioning of the new mammalian brain.
2. Reality principles: this means that the tasks students engage in must be real rather than contrived. This results in emphasizing the usefulness of what is learned.
3. Respect for natural thinking: the use of the brain in the PAC mode. This is not to imply that SSM thinking is to be discarded, but rather that both types of thinking are to be encouraged.
4. High input for pattern learning: a wide variety of input is needed so that students (their brains) can recognize patterns which results in a diversity of programs being acquired.

Most of these suggestions seem reasonable even if one does not accept Hart's Proster Theory of learning. Most are also reasonable even if one does not accept his severe criticism of the conditions which presently exist in the schools. The theory and its

implications, being relatively new, should at least give us something to think about.

References

- Gould, S. J. The panda's thumb. New York: W.W. Norton, 1980.
- Hardyek, C. D. Dividetur mens in partes tres? Phi Delta Kappan, 1981, 62, 507.
- Hart, L. A. How the brain works. New York: Basic Books, 1975.
- Hart, L. A. The new "brain" concept of learning. Phi Delta Kappan, 1978, 59, 393-396.
- Hart, L. A. The three-brain concept and the classroom. Phi Delta Kappan, 1981, 62, 504-506.
- MacLean, P. D. A mind of three minds: Educating the triune brain. In 77th Yearbook of the National Society for the Study of Education, Part II. Chicago: University of Chicago Press, 1978.

THE STRUCTURE OF INTELLECT:
OVERVIEW, USES, & IMPLICATIONS

Robert S. Ristow
Assistant Professor of Education
South Dakota State University

The Structure of Intellect (SOI) (Guilford, 1977) presents a model by which one can explore the many complex facets of intelligence. The model, which is expressed as a cube schema (See Figure 1), presents a theoretical framework involving as many as 120 types of intellectual abilities, many of which have been successfully identified. While the debate continues concerning the appropriateness of Guilford's use of the orthogonal rotation method of factor analysis (Maker, 1982), education must consider the learning impact of what has surfaced relative to those identified abilities.

Mary Meeker and her associates at the Structure of Intellect Institute in El Segundo, California have presented, researched, and developed a variety of curriculum materials and methods based upon Guilford's theories (Meeker, 1969). The purpose of this presentation is two-fold:

1. Present a brief overview of the model.
2. Discuss the implications and uses of the model for education, especially in light of the needs of special populations.

The Model: An Exploratory Look

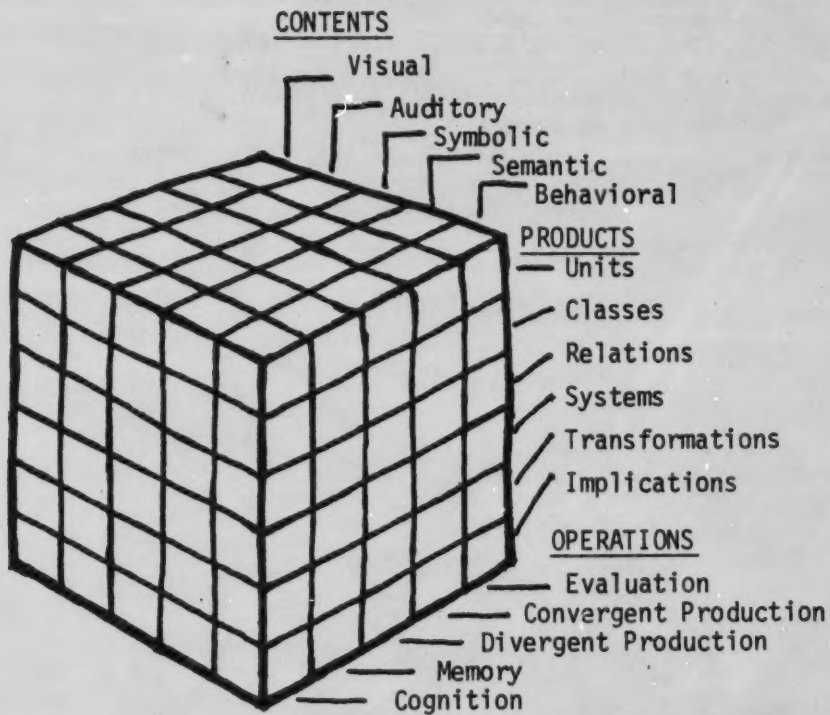
One's initial reaction to Guilford's SOI model is usually one of awe and fright. Most of us in education were exposed to this model in our first Psychology course or in the required Educational Psychology course. While much of the information presented during these trying times was complex enough in its abstractions, this model often seemed so confusing that usually well developed cognitive schemas had difficulty in organizing and categorizing the information. Both Guilford (1977) and Meeker (1979) have done excellent jobs at presenting the model in a way that is understandable and comprehensible. These two books are highly recommended for further explanations.

Figure one (1) presents the model as it is usually seen by students of psychology. As can be seen, the three major components of the model center around the ability to cognitively work with information (Cognition), the type of information one works with (Contents), and the way in which this information is worked with (Products).

Operations

Meeker (1969) defines operations as, "the things the organism does with the raw materials of information" (p. 13). According to Guilford (1967) there are five major operations that one performs: (1) Cognition, (2) Memory, (3) Evaluation, (4) Convergent Production, and (5) Divergent Production. Cognition is basic to

Figure 1



Taken from: Guilford, J.P. Way beyond the I.Q. Buffalo, N.Y.:
Creative Learning Press, 1977, p. 151.

the other operations. Memory and Productive thinking (Convergent and Divergent Production) occur in a natural sequence once Cognition has occurred. Evaluation relates to each of the other operations but cannot occur until each has been worked through.

Cognition is the "immediate discovery, awareness, rediscovery, or recognition of information in various forms; comprehension or understanding" (Meeker, 1969, p. 14). This is the most basic and perhaps the most understandable aspect of the model. After all, one must understand or comprehend information before one can process that information. At the most primitive level, cognition occurs with the recognition of visual and auditory information or simple shapes and sounds. At the more abstract level cognition involves the understanding of complex implications of language or behavior.

Memory is the "retention or storage, with some degree of availability, of information in the same form it was committed to storage and in response to the same cues in connection with which it was learned" (Meeker, 1969, p. 16). Memory, like Cognition, is perhaps the most comprehensible of the operations. Obviously, the ability to remember information for short and long periods of time is crucial to learning. From the simplest memory of one shape or sound, to the most complex memory for language and behavioral implications, one would need to relearn all information if it were not for the ability to remember. Indeed, it has been widely recognized that children with specific learning disabilities suffer from deficits in memory (Reid and Hresko, 1981,

p. 57). While discussions go on concerning how memory actually occurs, the need to recognize this as an aspect of intelligence exists, without a doubt.

Evaluation means, "reaching decisions or making judgements concerning criterion satisfaction (correctness, suitability, adequacy, desirability, etc.) of information" (Meeker, 1969, p. 17). In short, evaluation represents the matching of information recently cognized or remembered to existing structures and deciding on the "fit" of that information with already existing information. Or, as Guilford (1977) puts it, "Evaluation is the area of critical thinking" (p. 149). Certain criteria are necessary for evaluation to occur. Identity, the formation to certain specifications, and consistency between bits of information or internal consistency of the information are all involved in the logical criteria for evaluation. As Guilford (1979) points out, "Because of this logical criteria, the intellectual abilities of evaluation probably do not apply to the asthetic areas or to judgements in ethics" (p. 150).

Convergent Production or what is often referred to as "school block learning" (Meeker, 1969, p. 19) is defined as the, "generation of information from given information, where the emphasis is upon achieving unique or conventionally accepted best outcomes. It is likely the given information (cue) fully determines the response" (Meeker, 1969, p. 19). Thus, convergent production is the attempt to come up with the right answer

through a logical, deductive-reasoning approach. Areas such as mathematics, sciences and the law represent high levels of convergent thinking. Much of school learning focuses on this type of productive thinking.

Divergent Production has been defined by Guilford and Hoefner (1966) as, "generation of information from given information, where the emphasis is upon variety of output from the same source. Likely to involve what has been called transfer. This operation is most clearly involved in aptitudes of creative potential" (Meeker, 1969, p. 20). One obviously sees a contrast between this aspect of Operations and Convergent Production. While the latter focuses on a systematic method for zeroing in on a solution or answer, the former involves creative or unique solutions or answers to a problem. However, Divergent Production must not be mistaken with haphazard thinking. As Meeker points out (1969):

"On the one hand, divergent thinking should show fluency, flexibility, and individuality, an ability to break away from the conventional; but on the other hand, it should also show quality, relevance, and discipline, an ability to stay within 'reasonable' bounds" (p. 20).

Very often the divergent thinkers are those students who seem to travel to the beat of a different drummer. They are the ones who are always developing new ways to deal with old problems or whose answer or method for deriving the answer does not mesh with that reported in the teachers' manual. This is the aspect of

intelligence that many tests fail to assess. Divergent Production is what has been referred to as creativity.

Operations then, involves five elements: Cognition (C), Memory (M), Evaluation (E), Convergent Production (N), and Divergent Production (D).^{*} These elements are the ways one intellectually works with the raw information received.

Contents

Four basic types of material or "Content" are used in Operations. These are to some degree sequential and involve: 1) figural content, 2) symbolic content, and 3) semantic content.

Figural content is that which is perceived through the sense of systems of sight and touch as pictures, objects and/or other concrete information.

Symbolic content refers to that aspect of intelligence which deals with symbols. Letters and numbers are the most often recognized symbols. However, musical notation, shorthand, and mathematical notation are other forms of symbolic content.

^{*}Initials are used by Guilford to simplify this model.

Semantics involves the abstract, gaining meaning from language. While much of what we think about when looking at semantics would be consistent with verbal meaning, one must also recognize the internal (thought) aspects of semantic content.

Behavioral content is perhaps the most intriguing. While only a few abilities have been factored (Meeker, 1977), there certainly would seem to be validity in the hypothesis that there is a behavioral or social intelligence. Indeed, researchers have been looking at this area as a possible type of specific learning disability (Bryan and Bryan, 1978). This element deals with the nonverbal aspects of our intelligence that allows us to function appropriately as social beings. A very important and hard to measure aspect to be sure.

In summary, there are four types of content or materials that one works with: 1) Figural (F), 2) Symbolic (S), 3) Semantic (M), and 4) Behavioral (B). Each of these are worked upon by the Operations. For example, if one would point to a tree and say "tree" he/she would be Cognizing a Figure (CF). Or, if one were to respond to the question, "What are trees most often used for?" He/She would be Convergently Producing Semantics (NM).

Products

Every operation which is made up of contents is arranged from simple to complex. This is the structure of information or how it is organized in the brain and is referred to as Products. There are six types of products: 1) units, 2) classes,

3) relations, 4) systems, 5) transformations, and 6) implications.

In Neurolinguistic Programming one talks about "chunking down" to derive at the lowest common denominator. The product of Units is very similar to this denominator. Units involve single items such as one word, one concept, one picture or one letter.

Classes are, "categories or classifications of items grouped together because they have certain properties in common" (Meeker, 1982, p. 99-100). Of course, one must be able to perceive units before one could place those units into classes, or "classify" them. Thus, while "a", "b" and "c" are units when seen alone, they become a class when grouped together, "a b c".

The ability to formulate relations or connections between classes or units of information is seen by Guilford (1977) as Relations. One example of relations used by Guilford (1977) involves semantic relations. Given four words that relate in some way, the person is to choose a word to go in the blank that relates to the stimulus word.

"	a	b	a	b	a	b
1.	hard	soft	up	down	dry	<u>?</u>
2.	peach	fruit	pea	vegetable	beef	<u>?</u>
3.	fifth	swim	bird	fly	man	<u>?</u>
4.	hand	arm	hub	wheel	page	<u>?</u>

The answers and their reasons are:

1. wet (b is the opposite of a).
2. meat (b is the natural class to which a belongs).

3. walk (b is the natural mode of locomotion of a).

4. book (b is the whole of which a is a part)" (p. 31).

Systems, as explained by Maker (1982), are, "organized or structured complexes of interrelated parts, such as melodies and rhythms (auditory), numbers in a series, sequences of events, or cartoon strips" (p. 100). Thus, a system, the most complex of the types of information, involves the unique way in which information is connected. Electrical systems are highly complex forms of systems. Language (grammatical rules) are another type of system.

Transformation involves the changes in information. When one is using transformation, the person is modifying or redefining original information into something else. Puns are examples of semantic transformations.

The last product, Implications, involves the ability to foresee consequences or make predictions from given information. This is obviously, the most complex and abstract of the products. The "What if?" questions are examples of Semantic Implication. The ability to see consequences of a particular line added to a Draftsman's design would be an example of Figural Implications.

As can be seen, Products are arranged in a heirarchical fashion. Units (U) when grouped together form Classes (C). Classes when connected or related together are Relations (R) and these relations when bound together by rules or structure make-up Systems (S). The ability to Transform units, classes, relations or systems or modify them is called Transformation (T); while the

ability to draw consequences or make predictions from given information is referred to as Implications (I). These, then, make up the way in which information is structured or organized within the cognitive system.

When one views the total cube (see Figure 1), one is then able to see the possibility of 120 different cells or abilities which Guilford calls intelligence. For example, Cognition (C) for Semantic (M) Units (U) or CMU is the ability to recognize one word (Basic Sight Vocabulary). While Evaluation (E) for Symbolic (S) Implications (I) or ESI would be the ability to judge the various implications or consequences of a particular musical note or mathematical equation. Divergent Production (D) for Figural (F) Units (U) or DFU would be the ability to create something new from two or three single lines. While Convergent Production (N) for Figural (F) Classes (C) or NFC may be the ability to choose the shapes that are the same from five given shapes. Thus, as Meeker (1977) stated it, "There is not one IQ score. There are 120 kinds of measured intelligence" (p. 4).

Use and Implications of SOI for the Curriculum

What then are the implications for SOI in education and how might we use these concepts in the educational curriculum? Mary Meeker (1981) stated the implications well in a speech presented to the Pennsylvania State Conference for Gifted,

"The conclusion is inescapable: that further development of the human brain functions is a spiraling phenomenon and that schools must address the teaching of figural, symbolic, and semantic intelligence equally in the curriculum ... that we must proceed from Cognition to Memory to Evaluation to Divergent Thinking. Convergent thinking, the traditional school curriculum, is not enough" (p. 3).

In addition to this, the concept of IQ and intelligence must also be reanalyzed. Meeker's (1969) analysis of the Stanford Binet and Weschler Intelligence Scale for Children and her item relationship to the SOI model has provided us with a model to begin this re-evaluation. The importance here seems to lie not so much in the areas of individual intelligence testing, although this is important, but in the area of Group Intelligence testing. Here more than any other place, we may be doing a great injustice to our children. Many of these tests are not based upon any real theory of intelligence as are the SOI tests. And as Picola (1980) states, "Considering this, IQ scores are nebulous and are not always accurate in determining giftedness or, for that matter, intelligence" (p. 1).

Not only are the implications tremendous throughout education and in the field of intelligence and intelligence testing, but they are also critical for the field of special education. The findings related to memory and children with specific learning disabilities has already been alluded to in this presentation. Perhaps, activities to assist in the development of memory and evaluation would greatly enhance the chances of these children to succeed. Work in the area of evaluation may help students

diagnosed as behavioral problems. Curriculum that emphasizes all areas of the SOI model may benefit children with mild mental retardation.

While only a few of the implications have been presented here, one can easily see the possible far reaching effects of this theory. Gallagher (1981) alludes to the impact of this theory, and the model that has been derived from it by Meeker, for Gifted as well as all children when he says, "The model has really formed one of the fundamental bases for the changes in instruction that has taken place in programs for gifted children" (p. 1).

While some of the uses of this model have just been briefly outlined, further "food for thought" can be presented by exploring four major areas: 1) general education, 2) special education (including gifted), 3) education of the culturally different, and 4) research usages.

Uses in General Education

While, in the United States, the use of this model has not been undertaken as a general educational teaching tool, other countries have. Japan currently teaches ninety-five percent of the primary grade children intellectual skills as identified through the SOI tests (Picola, 1980). There are some pockets within the United States that are using the SOI model as a part of the curriculum. This use primarily involves the testing of children with the SOI Learning Abilities Test (Meeker and Meeker)

and then spending a set amount of time developing those areas found weak on the test. The research that has been done would indicate that SOI training can be successful in developing SOI skills and in improving academic achievement (Maker, 1982).

Uses in Special Education

The possible uses in special education are especially interesting. While most of the publicity for the SOI model is found in reading related to gifted education, there have been some interesting uses with special needs children. The diagnostic-remedial model seems to fit well here. Children are given the SOI Learning Abilities Test and/or one of the special tests such as the SPecial EDition (sic) form or the Vision of Career forms (Meeker and Meeker). Remediation is then accomplished through several means.

1. The child's intellectual strength could be used to teach concepts needed to learn and remediate his/her weak abilities.
2. Two strengths abilities could be used to help remediate on weak ability.
3. One could progress systematically through one or all of the Operations.

Uses in Multicultural Education

Meeker has reported on the qualitative differences among disadvantaged boys (Baldwin, Gear, & Lucito, 1978). The research reported yields some interesting data concerning the differences

in abilities among children from varying cultures. She reports that, with gifted children (IQ's ranging from 132-153), Anglos were higher in Cognition than Chicanos and Blacks. However, Blacks and Chicanos were higher in Memory than Anglos (p. 19). Also, while Anglos and Chicanos were higher than Blacks in Evaluation, all three groups were low in this area. Interestingly, Chicanos were much higher than both groups in Figural Intelligence and, as might be expected, Anglos were much higher than the other groups in Semantic Intelligence (p. 20). In the area of Products, the research indicates that Chicanos and Anglos were higher than Blacks on three of the six elements: 1) Units, 2) Classes, and 3) Relations. However, Blacks and Chicanos were higher than Anglos on Systems, with Chicanos being significantly higher than the other two groups. All three groups were very low in Transformations with Blacks somewhat higher, while the Anglo and Black group was higher in Implications (p. 22).

All of this would indicate the need to analyze the curriculum and begin to adapt various aspects of the curriculum to better meet the intellectual abilities of various groups as well as assist those children in the development of a more global intellectual capacity.

Research

Some of the research uses have already been identified. It would seem, however, that much more needs to be done. As Maker (1982) points out, "More effort must be focused on such

research *(Gifted) by those who advocate its use" (p. 131). The SOI model could be used for research into individual learning styles, and what happens if the curriculum is adjusted to meet these styles. It could be used to help develop a more comprehensive identification system for gifted and talented children. Research using this model could be developed to assess its useability and success with special needs and multicultural population. Lastly, longitudinal research needs to be conducted to assess the validity of using such a model as a part of the regular educational curriculum.

Obviously, these are but a few of the many uses for this model. While it certainly is not going to replace the present curriculum, nor does this author believe the intent was to do that, the model certainly presents educators with another spoke for the learning wheel.

Concluding Remarks

One cannot mistake the long term impact that the SOI model will have on all facets of education. While the information presented here was only an introduction into the theory and the uses of the model, certainly anyone reading it can visualize the impact. One must be careful, as well, of their zeal towards the complete global implimentation of this model. Many authors

*Word inserted by author.

have recommended, and this author would agree, that this should not be used as a total curriculum, but as an integral part of the curriculum. In this light, the Structure of Intellect, as researched by Guilford and his associates and as operationalized by Mary Meeker, has a firm basis for use in the educational arena.

Selected References

- Bryan, Tanis H., & Bryan, James H. Understanding learning disabilities. Sherman Oaks, Cal.: Alfred Publishing Company, 1978.
- Gallagher, James J. An interview with James J. Gallagher. Columbus, Ohio: The Directive Teacher, Summer/Fall, 1981.
- Guilford, J. P. & Hoepfner, R. Structure of intellect tests and factors (Report No. 36). Psychological Laboratory, 1966.
- Guilford, J. P. Way beyond the I.Q. Buffalo, N.Y.: The Creative Education Foundation, Inc., 1977.
- Maker, June C. Teaching models in education of the gifted. Rockville, Maryland: Aspen Systems Corporation, 1982.
- Meeker, Mary Nacol. The structure of intellect: Its interpretation and uses. Columbus, Ohio: Charles E. Merrill, 1969.
- Meeker, Mary. SOI coloring book for educators. El Segundo, Cal.: SOI Institute, 1977.
- Meeker, Mary. Nondiscriminatory testing procedures to assess giftedness in Black, Chicano, Navajo, and Anglos: In Baldwin, Alexinia, Gear, Gayle, and Lucito Leonard. Educational planning for the gifted, overcoming cultural, geographic and socioeconomic barriers. Reston, Virginia: Council for Exceptional Children, 1978, pp. 18-22.
- Meeker, Mary and Meeker, Robert. SOI learning abilities test: Examiner's manual. El Segundo, Cal.: SOI Institute.

Picola, Greg. SOI testing could replace I.Q. El Segundo, Cal.:

SOI Institute, July, 1980.

Reid, D. Kim, & Hresko, Wayne P. A cognitive approach to
learning disabilities. New York: McGraw Hill, Inc., 1981.

LEARNING SPURTS AND PLATEAUS

Bob Rose
Elementary Principal
Hot Springs, South Dakota

Dr. Herman T. Epstein has discovered through research that children learn in spurts, brain growth periods, and not a continuum. This concept should change the way children are educated. In some cases the changes will be drastic and will be met with opposition from many traditionalists. If educators are truly student oriented then the learning spurt and plateau concept will be adapted into their curriculums.

Before the actual presentation of Epstein's theory, some background in the human brain needs discussing. The human brain weighs approximately one pound at birth. Basic, non-voluntary muscles which control respiration and circulation have developed as well as consciousness. These areas are controlled by the reptilian portion of the brain and are the most basic for animal life. During a child's first year its brain adds the second pound. Much of the brain growth is in the cerebellum where conscious directions such as speaking, eating and motor commands are controlled.

By the end of the first year all of the brain cells have been formed. The third and final pound of brain weight then is not from cell creation, but the mass of tissue that connects cells together. This expansion of tubular projections, called dendrites, forms a path from one cell to another which allows

the transfer of information in chemical form. The critical point at which two cells make contact with their dendrites is referred to as the synapse. Without synapse the chemical transfer of information cannot be conducted. When learning occurs the path that allows the biochemical transmission of signals from one cell to another becomes an axon which is surrounded by a myelin sheath to prevent any weakening of the signal. The increase in brain density at specific intervals signals the learning spurts.

Chronological ages have been determined by Dr. Epstein for learning spurts (growth periods), and plateaus (non-brain growth periods). Dr. Epstein's cycles of learning coordinates well with Jean Piaget's learning stages. The learning spurts and plateaus are as follows (The School Administrator, 1980):

<u>Spurt Ages</u>	<u>Plateau Ages</u>
3 - 10 months	3 - 10 months
2 - 4 years	4 - 6 years
6 - 8 years	8 - 10 years
10 - 12 years	12 - 14 years
14 - 16+ years	16 years into adult life

Piaget's cognitive response levels correspond to the 3 - 10 month spurt with the sensorimotor stage. The preoperational stage of language development and judging things on face value matches with the 2 - 4 year old learning spurt. Concrete operations are matched with the 6 - 8 year spurt which are the reading and writing development ages. Formal operations do not begin until the 10 - 12 year learning spurt when children begin

to understand the concepts of hypothesizing and deducing possible consequences to help solve problems. The 14 - 16 year spurt is matched with a fifth stage of learning that modern Piagetians believe exists. In this stage children develop problem finding and self-awareness concepts. Through years of research on how and when children learn, the above scale is factual for 85 to 90 percent of all average and above average ability children.

The last two learning spurts show definite differences in boys and girls. Girls' brains outgrow boys' by three times during the 10 - 12 year spurt. During the 14 - 16 year spurt the boy's brain outgrows the girls' by three times (Sylwester, 1982). This indicates that learning abilities for the sex groups are much different at these times. Higher level mathematics are generally introduced during the 14 - 16 year brain growth period. Girls may be more ready to learn these types of concepts during their brain growth ages 10 - 12 years old while boys are already being taught during their accelerated spurt, 14 - 16 years old. Consequently boys perform better on mathematical tasks.

Other education programs are not working well due to the age of the children who they are trying to teach. Children in the plateau years of 4 - 6 are not capable of mastering academic ideas. Therefore, socialization needs to be stressed. Schools need to strengthen areas that the children have already been exposed to at home--developing family relation concepts, how to get along with peers, and life skill areas such as types of

clothing to wear during different temperature and weather conditions. Head Start had much more success with older children and showed excellent gains for children ages 6 - 8 who are experiencing learning spurts (Toepfer, Note 1).

Public schools need to reorganize their curriculums to better meet the cyclic needs of the children. Elementary students are receiving many skills at the correct age level. But the middle school years are not in contact with the children they teach. These schools are commonly referred to as the "sick man of education" (Cramer, 1981). Children are being taught concepts that only 12% of them are capable of learning. Seventy-six percent of the students go through three years of not understanding "the language they are being taught" (Cramer, 1981). Only 24% can use any type of formal reasoning by the time they reach high school. "The push in middle grades accounts for an alarming degree of turn-off of learning and achievement ... that might be caused by overchallenging learners" (Cramer, 1981).

As administrators and teachers, we are accountable for the education of children. If changes are to occur that allow the best education for children, it must come from us, the experts. Look at your curriculum. Be sure it introduces new concepts during learning spurts. You need to be aware of the Piagetian cognitive response levels and assess the level of your students. Maintain high expectations, but do not teach concepts that students are unable to learn. Follow proven researched techniques and above all be aware of where your students are. Are they in a learning spurt or a plateau?

Reference Note

1. Toepfer, C. F. Brain growth periodization research: Curricular implications for nursery through grade 12 learning. Unpublished manuscript. Department of Learning and Instruction, State University of New York at Buffalo.

References

- Cramer, J. The latest research on brain growth might spark more learning in your schools. The American School Board Journal, 1981, 168 (8), 17-20.
- Sylwester, R. A child's brain: Part I. Instructor, 1982, 92 (2), 90-96.
- Why do some students seemed turned-off to learning. The School Administrator, September, 1980.

LEFT BRAIN/RIGHT BRAIN:

MORE OF THE SAME?*

Gary Steinley
Assistant Professor of Education
South Dakota State University

The current furor about hemispheric differences has had a dreadful impact on me. It has forced me to re-examine some of my own teaching in the literature classroom; and, worse yet, it has led me to conclude that a mistake or two might have been made. But there's been a positive result. It has also helped clarify some teaching practices I can follow in the future.

Let me explain.

First, I've become convinced that reading--especially the reading of literary texts--is a "whole brain affair." (A phrase I've borrowed from several authors.) In other words, reading requires processing strategies characteristic of both cerebral hemispheres. It requires, for example, the analytic, detail-oriented strategies of the left; but it also requires the synthetic, global strategies of the right. As a reader, I attend to details and parts, and I'm aware of their passing before me in a sequence; but I am also grasping the text as a whole--a whole defined by a unifying mood, idea, design, or whatever has been conjured up by my interaction with that particular text.

*Previously published in Language Arts, April, 1983.

Likewise, reading requires some rational, conscious, logical processing typically associated with the left brain; but at the same time, it requires a denial of all of that, a trust in the intuitive, fantasizing, unconscious, perhaps even irrational processes of the right. Reading, in short, is an interactive process--not only an interaction between me and the text, as it is so often defined, but also an interaction between two modes of thinking which work together toward a whole literary experience.

Now there's nothing especially new about those observations. Plenty of good people have made them before me or before left brain/right brain theorizing became popular. Without going to antiquity, I immediately think of what David Bleich, George Henry, or Louise Rosenblatt have recently said about the total process of reading literary texts. But, even though the ideas may not be new, they provide a concrete and visual platform from which one can analyze his or her own teaching, and, more important, they provide a manageable framework for changes.

In my case, the analysis showed a left-brain bias. I think much of what I had my students do with texts required the kind of processing more associated with the left hemisphere. Of course I didn't actually control their minds while they were reading, but what I expected of them--or more accurately their expectations of me--surely influenced the strategies they evoked while reading. And I expected them to be analyzers, to isolate patterns, to explain causes, to think about what they've read, to evaluate, to draw and support conclusions, etc.--a lot of left

brained activities! Surely we had some fun, creative activities, and, yes, I often talked about the need to respond emotionally to texts; but by and large I think my students felt that the real business of reading literary texts was analytical. They read how they needed to read, analytically, in order to survive in my classes.

I may not be very typical. But, since I used anthologies and teacher's guides used by many, and since I was trained, originally, in formalistic criticism, I suspect I am. The problem with the left brain bias which I/we may have been perpetuating is twofold. The immediate concern is that, by doing things that might shut off right brain processing, we're possibly cutting them off from a complete understanding and experiencing of those wonderful texts we've taught. But there's another problem which is more long-range and more damaging. By our repeated practice over many years of literature classes, we're implying a schema for reading literary texts. And, if our pattern is more favorable to the left brain, we're implying that such reading is primarily analytical. Regardless of what we might say or believe to the contrary, I fear it is our practice which shapes their schema.

If current left brain/right brain talk has led me to dismal conclusions like the above, it has also led to some more encouraging signs. For one thing, I (and I'm sure none of us) haven't blown the whole thing. I did have activities that required such right brain strategies as synthesizing, fantasizing,

feeling, etc. Moreover, I'm convinced that at least part of the solution involves doing more of those kinds of things which I had already been doing. That's the good news. To help students more fully understand and experience what they're reading and to help them develop a more integrated schema for reading literary texts, I think I have to do a lot more of some things I've been doing. In my years of teaching, few educational advances have seemed to offer such an easy route toward improvement.

To illustrate this "doing more" concept, I've included below a list of general areas in which this improvement might take place. Each area corresponds with a kind of processing typically associated with the right brain, and under each I've listed some samples of the kinds of activities and classroom practices which might facilitate those areas. No claim is made for original activities here. In fact, they may all be old hat. But it is important to remember that they're being presented as more than fun things to do, or things to do on Friday afternoons, or even as creative activities. They're more than that. They are being presented as the kinds of activities which must share an equal role in literature instruction.

1. Use more activities that encourage visualizing as one reads:
 - a. In class, read descriptions of characters, scenes, actions--then enrich them as a group by filling in missing details. (Was she thin? Would she look like ...? Was the river wide or narrow? Could you throw a rock across it?)

- b. Before reading have students relax, close their eyes and visualize scenes, characters, etc., that they'll meet as they read the text.
 - c. Have students draw an illustration for the story or create an abstract design which captures what they see as its essence.
 - d. Re-commit yourself to bulletin boards and their potential for making the abstract concrete.
2. Encourage more emphatic reading, more trust in emotions and feelings as part of reading:
- a. Before reading, help your students turn off the left-brain analytic machinery with instructions such as "get to know the people in this story" or "choose a character you like and read from that character's point of view."
 - b. Before reading, discuss sad moments (or embarrassing ones or whatever the story contains) which students have experienced. After they read, discuss--were their feelings similar to those of the characters?
 - c. Let students know that it's legal to cry and laugh when they read.
3. Pay more deliberate attention to metaphorical thinking:
- a. In class, expand the notion of metaphors. They're not just figures of speech, but a way of thinking.
 - b. Have lots of "this is like ..." exercises.

- c. Distinguish between logical and analogical. Have students develop analogies for ideas or complicated processes.
4. Provide more opportunities to read and respond holistically:
- a. Begin reading with student-generated predictions, hypotheses over what the story will be about. Read, discuss hypotheses, how they change, how they shape a reader's interpretations, etc.
 - b. Have students read with the intention of coming up with one word or phrase or image that sums for them the text as a whole, or one that sums how they felt while reading the story.
 - c. Use more holistic questions in post-reading discussions.
 - d. Use content area reading techniques, such as concept guides or structured overviews, which encourage a holistic grasp of stories.
5. Spend more class time playing, fantasizing, and combining data in unpredictable ways:
- a. Consider discussion topics like this: "What do a shoe, a house, and the Scarlet Letter have in common? Or this: "This is what did happen in the play. Now what would have happened if ...?"
 - b. On the board play free-wheeling word association games. Create huge webs of associations between

concepts, images, etc. Allow and reward random mental explorations.

- c. Encourage thought about new meanings for familiar concepts and ideas. For example, we usually think of language as a form of communication. What if we thought of it as a form of manipulation? A form of masturbation? A form of standardization?
6. Allow more ways for responding to literature (besides writing and talking):
 - a. Have students choose songs or pictures which express similar feelings or moods as something just read.
 - b. As students read have them record phrases, ideas, images, etc., that somehow stand out for them. These can be discussed or written about later, but they don't have to be. Each student could, for example, arrange his or her impressions on a personal montage which represents his or her experience of a story.
 - c. Let students do nothing--a response we often choose in life.
7. Encourage the reading of more texts which require right-brain strategies:
 - a. Help make fantasies part of their reading menus.
 - b. Return to Joyce, Vonnegut, Barthelme, Faulkner, Emerson, etc., as writers who should probably be read less analytically and more holistically, with

less probing for sequences and logical orders and more acceptance of fractured time, with less thought and more feeling.

Surely more areas and many, many more examples could be added. But I think I've made my point. If reading literary texts is indeed a whole brain affair--and it is--then the hundreds of hours our students spend in our classrooms must enhance the total process. And we're lucky. It primarily involves doing more of what makes reading and teaching pleasurable.

CULTURAL DIFFERENCES IN THE CLASSROOM
AS MANIFESTED IN COGNITION
AND NON-VERBAL COMMUNICATION

Ronnie D. Theisz
Associate Professor of Communication and Indian Studies
Black Hills State College

"Joe, these people say they want flesh-colored band-aids!" the sales clerk in the cartoon calls anxiously to the back as he is faced by members of several diverse cultural and racial groups. He must realize the flesh color on the shelf will not correspond to most skin tones in question.

I like to use this cartoon to suggest to students, colleagues, and others that traditional classroom education has too long and too often been designed to suit one group, the dominant, modal Euroamerican student. The compelling implication is that linguistic and cultural differences require some special strategies and that the committed educator ought to implement them.

Though certainly not eagerly embraced by all educators, this claim has a long heritage of advocacy. It rarely packs enough clout, however, to gain the political support necessary to actually affect the classroom process.

During the late 1960's and 1970's the civil rights political momentum led to the advent of a sometimes zealous sometimes groping movement to consider the significance of culture in teaching and learning. The first identifiable current, referred to as biculturalism, was pretty much concurrent with the bilingual movement marked by the 1967 Title VII Act of the Elementary and Secondary Education Assistance Act of 1965. Backed by considerable

community pressure, this trend went through the normal growing pains, experienced a climax and then somewhat of a decline by the late 1970's. At the present time, biculturalism, perhaps because the political support waned, perhaps because the economy in the United States emitted foreboding signals, has lost some of its élan.

Fortunately, in running the same course as many other educational innovations, bicultural/bilingual education began to develop a growing body of research to substantiate its claims that cultural and linguistic differences ought not be shunted aside but rather that they be used to assure optimal learning. Though not without some internal disagreement on the actual efficacy of various bicultural/bilingual approaches, these research findings began to replace the moral/social/historical arguments with pedagogical ones. Improvements in self-concept, various types of achievements, greater creativity and problem solving thus began to supersede the earlier primary stress on retention, community acceptance, control and involvement, and educational as well as social equity.

Along with this slowly growing body of research substantiation of the bicultural/bilingual approach, the 1970's began to see a shift towards multiculturalism nationally. Colleges, universities, and accreditation associations began to formulate multicultural philosophy and to implement it. The AACTE (1973) statement No One Model American is representative of this evolution:

Colleges and universities engaged in the preparation of teachers have a central role in the positive development of our culturally pluralistic society. If cultural pluralism is to become an integral part of the educational process, teachers and personnel must be prepared in an environment where the commitment includes such factors as a faculty and staff on multiethnic and multiracial character, a student body that is representative of the culturally diverse nature of the community being served, and a culturally pluralistic curriculum that accurately represents the diverse multicultural nature of American society (p. 264).

At Black Hills State College, where I teach, a Multicultural Concerns Committee was established in 1980 to determine how the campus was meeting the multicultural standard set by NCATE, one of the agencies which accredits our campus. The NCATE (1982) definition of multicultural education reads as follows:

Definition

Multicultural Education is preparation for the social, political, and economical realities that individuals experience in culturally diverse and complex human encounters ... This preparation provides a process by which an individual develops competencies for perceiving, believing, evaluating, and behaving in differential cultural settings. Thus, multicultural education is viewed as an intervention and an ongoing assessment process to help institutions and individuals become more responsive to the human condition, individual cultural integrity, and cultural pluralism in society (p. 14).

The Black Hills State College Multicultural Concerns Committee, as part of its mandate, then came up with the following working statement:

Multicultural education reflects the recognition of the pluralistic nature of American society. It affirms both the necessity as well as benefits of addressing cultural diversity in the theory, curriculum content, and methodology of education whether in culturally mixed or homogeneous classrooms.

Rather than casual reference or offering an isolated course on any specific culture, multicultural education stresses that cultural awareness and knowledge be considered in an institution-wide, regular, and integrated manner in the classroom. Furthermore, this aspect of education should be pursued outside of the classroom per se including library and media holdings, counseling and advising students, and faculty and student recruitment.

Several central issues require special focus in the classroom as well as multicultural teacher education:

1. cultural diversity and individual uniqueness
2. value clarification and transmission of values
3. the historic and current dimensions of minority experiences
4. location, development, incorporation and evaluation of culturally diverse materials

5. recognition of and skills needed for students speaking English as a second language
6. cultural issues in testing and assessment
7. culturally different learning styles
8. non-verbal communication differences between cultures
9. the sociolinguistic aspect of learning

Finally, it is felt by this committee that the above areas be actively pursued via planning, implementation and monitoring on an ongoing basis (Black Hills State College, 1982).

The "melting pot" metaphor in use for roughly the first sixty years of this century for the essentially assimilating, unilinear course of American socialization and classroom instruction had by the late 1970's, due to the pluralistic philosophy of multicultural education, become the "tossed salad" metaphor. I hesitate to come up with a culinary metaphor for the above intervening bicultural/bilingual movement which peaked in the early 1970's but which had also enjoyed some vigorous support in the late 1930's and early 1940's in Federal Indian Education policy.

As the multicultural movement began to mature, it created greater awareness and refinement of several issues. Two of the most significant and, in my estimation, most exciting ones were the question of how the brain processes information and the sociolinguistic aspect of human interaction, particularly in the classroom.

In the early 20th century, neurolinguistics became fascinated with the distinction between the so-called "primitive mind" and the thought process of literate, industrial societies. The early anthropologist movement investigated what it felt to be the distinguishing characteristics of tribal, simple, preliterate and preindustrial groups who were felt to pursue thought in an intuitive, irrational, mythical and concrete manner. By comparison, it was argued that modern, technological societies developed abstract, logical, objective and factual modes of thought. The former groups tended to be linked with the moon as well as dionysian emphasis, the latter with the sun and apollonian. This movement in early brain research was led by scholars such as Franz Boas, L. Lévy-Bruhl, Hans Kelssen, Henry Frankfort and Benjamin Whorf.

In the 1950's, with the increase in split brain operations, a new spirit was infused into the dormant interest in cognitive functions. Many tests were now applied to demonstrate hemispheric duality and hemispheric asymmetry. Evidence mounted to indicate that each hemisphere of the brain processes information in different ways; the left is good at verbal, logical, and linear tasks; the right at spatial and constructional tasks. The results still pointed to the right hemisphere as merely a "bumbling backup" for the left.

In the course of the 1960's and 1970's the concept of brain asymmetry was extended to specify the different ways in which each hemisphere processes information. (As other essays in this

volume provide specific empirical findings regarding the processing of information, I will provide only a somewhat sketchy overview of those functions critical to my concern with intercultural comparisons.) Hence, the left "sees" in a part-specific way, focuses on detail but without an overall grasp of a configuration and verbalizes its findings. The right, by contrast, takes a configuration approach as it "focuses" on the whole while ignoring details. (Witkin, et. al. (1962) advanced the concept of "field-sensitive" versus "field-independent" in describing the way individuals will perceive experience. They have thus added another conceptualization of bicognitive processing to the earlier ones.)

Cognitive research in the 1980's is verifying, revising and refining the findings of the previous periods. J. Bogen, for example, represents the current emphasis on the difference between the two hemispheres being not so much content-specific but rather process-specific. That is, the left hemisphere splits into parts that are identifiable and quantifiable. It processes these one-at-a-time in sequential order to lead to logical thought. The right hemisphere, on the other hand, lumps the world holistically and relationally all-at-once while ignoring gaps.

In the waning 1970's this complex of research data regarding learning styles and cognitive modes, in somewhat of a return to its own beginnings, came to be applied once again along lines of cultural difference. This time educational equity provided the center of gravity. Given the ample evidence that minority

children--especially Black, Native American, and Chicano--were achieving less and remaining in our schools less, one of the more recently popular explanations has pointed to cognitive differences between the dominant Euroamerican society and minority groups. The former has generally been portrayed as left-brained while the latter have been depicted as right-brained. Further, it is being argued, the school establishment favors the left-brain style, that is the verbal, specific, lineal, stimulus-centered modes. In so doing, classroom learning has neglected the relational, holistic, self-centered style which tends to be found in minority homes and communities. The pupil who proceeds in the relational, lumping and intuitive manner will therefore not "achieve" in the eyes of the cool, analytical and impersonal school environment. It has also been found that low-income groups function along dominantly relational modes whereas middle income groups favor the analytical modes. Whether cultural minorities generally favor the right brain because of their cultural orientation or because of their low socioeconomic status poses an interesting question.

Many Native Americans, the cultural group I am personally and professionally committed to, find some gratification in being portrayed as right-brained. Although the more perceptive, or should I say cynical, among them see this as a new label to be added to those of the past, many others rather eagerly accept the generalization as a positive one. Their values, perceptions and thoughts as well as behavioral styles are now seen through a

more positive lens than before. Being right-brained is "whole-some" and somewhat of a benefit. The reliance on the functions of the left, now seen as characteristic of Euroamericans, smacks of deficiency or deprivation.

One particular research activity which exemplifies the trend of tying cognitive processing to cultural difference is the research of Dauna Browne, University of South Dakota professor, which seeks to determine whether there is a style of information processing unique to the Native American--in this case, the Sioux students of St. Joseph's Indian School in Chamberlain, South Dakota--and if so, whether it is related to greater dependence on right-hemispheric functioning. Browne's as yet unpublished research leads her to answer with a clear yes to both questions.

Using the WISC-R test on 197 Sioux children, she finds that on the verbal subtests, which require heavy dependence on the language specialization of the left brain, the children perform below the national mean. By contrast, however, the performance subtests which require the holistic processing of the right brain led to scores above the national mean. Furthermore, Browne points out that the group which is more traditionally Indian shows an even stronger preference for right brain processing than the rest of the Indian pupils.

The differences in Indian children's performance on the verbal and performance subtests have been noted before (See, for example, D. Mc Shane, 1979). But Browne concludes in

applying her hypothesis, that right hemispheric preference is clearly at work.

I tend to agree with her general conclusions although I would also suggest other variables which might affect the results of her study. Without conclusive empirical data to rely on, I would nevertheless suggest that several points be considered. First, questions on the WISC Comprehension subtest have already been shown to contain cultural bias (See Walter Higbee, 1972). Secondly, rural bias on the subtest seems to work in favor of most Indian or rural children as knowledge of farm animal terminology is required on some questions. Furthermore, SES bias puts the generally poor Indian child into question situations that only middle class children would know, such as contributing to charity or having a checking account, for example. Moreover, some other questions rely on learned information--how many miles is it from ..., how tall ...--which the Indian child might have less exposure to than the middle class white child.

Another significant dimension which I would strongly suggest affects Browne's results is the role of sociolinguistics and specifically non-verbal communication. The social rules of language use, of "communicative competence" (Cazden and Hymes, 1972) and of participation in classroom and community events (Philips, 1974) might affect the relationship between the adult tester and the student taking the test. The way the test is administered can thus clearly affect the performances of children.

Achievement on the test(s) is accordingly likely influenced by non-verbal elements. Attitudes, interest, and expectations of the person administering the test would be transmitted to students in a variety of non-verbal cues. Kinesic (body movement), proxemic (space relationships and the meanings a culture ascribes to them), and paralinguistic (voice quality and vocal mannerisms) messages convey emotions (liking/disliking), feelings of authority relationship, and the responsiveness of one individual to another or to a group. Non-verbal signals furthermore qualify the verbal message and are more reliable as true indicators of emotions and feelings than verbal communication.

As cognitive hemisphericity research is beginning to cross over from somewhat esoteric research to more general consumption, so research in non-verbal communication has been reaching practicing educators, business people, social service professionals and the like. We, in the teaching profession, for example, are becoming more sensitive to the fact that good teaching relies heavily on the ability to communicate well non-verbally (See Galloway, 1976). In a similar vein, non-verbal research knowledge is being applied in many other fields involving human communication. (A good set of essays may be found in Wolfgang, 1979.)

The study of non-verbal communication interfaces with the research in cognitive asymmetry when cultural difference is examined. To be sure, that non-verbal systems of communication differ from culture to culture, sometimes markedly, other times

imperceptibly, can hardly be disputed. Too many instances of incongruity in non-verbal systems across cultural lines have been experienced and noted. One need only to turn to the works of Edward T. Hall (The Silent Language, The Hidden Dimension, and Beyond Culture) for representative research in this regard.

Though not as widely accepted, conclusions about cultural differences in cognitive functioning are being advanced with increasing vigor. The clear inclination of non-Western or low SES groups toward the right side of the brain and of most Euroamerican groups toward the left is emerging as a major tenet of the field.

The consequences for the teacher of culturally different children but also for all teachers seem quite clear. Teachers working with children from other cultures--especially those that have been historically oppressed and denied educational equity--must address these two dimensions of bringing about successful learning. I would agree that not all aspects of cultural preference or even the more developed non-verbal behavior field are fully explored. Yet, hemispheric preference and the non-verbal aspect of human communication have provided new momentum to the concern with assuring that learning take place. Some minority groups are themselves eagerly accepting the conclusions but, it must be said, these conclusions may once again deny the complexity of human beings and lead to new stereotypes.

References

- AACTE Commission on Multicultural Education. No one model American. Journal of Teacher Education, 1973, 24, 264-265.
- Cazden, J. and Hymes (Eds.). Functions of language in the classroom. New York: Teachers College Press of Columbia University, 1972.
- Galloway, C. Silent language in the classroom. Bloomington, IN: Phi Delta Kappa Educational Foundation, 1976.
- Higbee, W. Do bananas telephone? Proceedings of the Missouri conference on the legal and educational consequences of the intelligence testing movement: Handicapped and minority group children. Columbia, MO: The University of Missouri, 1972.
- Mc Shane, D. Assessment of American Indian children using Wechsler Intelligence Scales: A review. White Cloud Journal, 1979, Summer.
- National Council for Accreditation of Teacher Education. Standards for the accreditation of teacher education (Newly revised). Washington, D.C.: Author, 1982.
- Philips, S. U. The invisible culture: Communication in classroom and community on the Warm Springs reservation (Doctoral dissertation, University of Pennsylvania, 1974). Dissertation Abstracts International, 1975, 36, 380A-381A. (University Microfilms No. 75-14, 610)

Witkin, Dyk, Faterson, Goodenough, and Karp. Psychological differentiation. New York: Wiley, 1962.

Wolfgang, A. Non-verbal behavior: Applications and cultural implications. New York: Academic Press, 1979.

INDIVIDUALIZING LEARNING STYLES--DUNN MODEL

Lois Widvey
Professor of Education
South Dakota State University

Everyone has a learning style, a way of approaching instruction that helps a person to understand and remember what one needs or wants to know. Having an individual learning style is certainly not innovative. Human beings since the beginning of time have been learning and working in different ways, and at varying rates of time. Still, educational institutions have traditionally been organized, and teachers within those institutions have taught, in a manner that assumed that most students learned in much the same way. Rita and Kenneth Dunn, along with other educational researchers, have been assisting in dispelling the myth that students at given age and grade levels learn in the same manner (NASSP, 1982).

Research in learning styles indicates that even in the same family, siblings often learn in much different ways. Children's learning styles tend to be different from those of at least one parent in that marriage partners, according to Dunn (1981), tend to have learning styles that are opposite. Since parents' learning styles are not necessarily reflected in their children, and since siblings' learning styles usually are more different than similar, it is not known whether learning styles are biologically inherited or environmentally developed. Theoretically, it seems that some elements of learning style tend to be influenced

more by genetic structure, while other aspects of learning preference tend to be environmentally developed. Research data produce at least twenty-one categories or elements that, when classified, suggest that learners are affected by their:

(1) immediate environment (sound, light, temperature, and design); (2) own emotionality (motivation, persistence, responsibility, and need for structure or flexibility); (3) sociological needs (self, pair, peers, team, adult, or varied); (4) physical needs (perceptual strengths, intake, time, and mobility); and (5) psychological elements (global, analytic, hemispheric preference, and preferences such as those affecting how learning is ordered or sequenced) (NASSP, 1982). Most people are affected by from six to fourteen of the elements; some people are affected by all of them. Regardless of age, IQ, socioeconomic status, or achievement level, individuals respond uniquely to their immediate environment when they are attempting to learn something new, especially if the learning task is difficult.

In regard to the effect of the immediate environment on learning, it is thought that the learner's preference in regard to sound and light level, room temperature, and room design are probably more closely related to biological conditions than to environmental factors. Eye sensitivity determines preference for light level, preference for temperature results from skin and body condition, and a learner's bodily needs appear to reflect the preference for a straight chair as opposed to a lounge chair, as well as such factors as chair and desk height.

The emotional elements of learning style appear to be an outgrowth of both the environment and each person's emotional makeup. Motivation, persistence, responsibility, and the need for either structure or options are inherent within each person, as well as being affected by environment.

Sociological elements affecting learning preferences are probably environmentally based. Some students learn best by themselves, away from the distractions of other students, the teacher, the formal classroom design, and perhaps, even apart from some traditional instructional strategies typically used in classrooms. Some students learn best when they are interacting with other students, and some students respond well to adults in general, including their teachers! There are also students who can be especially perplexing to teach because they do not achieve well with other people of any age and neither can they work well alone.

Physical elements that affect learning seem to be primarily biological in origin in that they are the tendencies that result in a student being primarily an auditory or visual learner, or both. Other physical elements include the tendency for some learners to learn more readily if they can eat, drink, or chew gum while they are studying, and the physical need for mobility that varies from one student to another.

Psychological elements appear to be both biological and environmental in origin. The hemispheric preference of the brain, along with the varied preference of how learning is sequenced or

ordered is undoubtedly a result of combined causes.

Although there is a tendency for some people, that is, those whose style of learning and questioning is such, to inquire as to why there are differences in learning styles, it is much more important for teachers to be able to diagnose learning styles with the ultimate goal of using this knowledge to assist students to learn.

Teachers can do this informally by being alert to the different elements of learning within the five categories mentioned above and identified by the Dunns and being perceptive of these elements in students. There are also a number of formal instruments that have been developed during the past few years that can be helpful in identifying students' learning preferences. One of these that has been developed and used extensively by the Dunns and one of their colleagues, Gary Price, is a learning style inventory based on factor analysis and is a comprehensive approach to diagnosing each student's learning style (Dunn, Dunn and Price, 1978). The instrument is useful in analyzing the conditions under which students prefer to learn, and assesses individual preferences in regard to environment, emotional factors, and sociological, physical, and psychological needs and tendencies of students. The learning style inventory can be completed by students in grades three through twelve in approximately thirty minutes. The completed inventories are then computer scored and analyzed, providing the teacher with not only an individual learning style profile for each student but also a

class profile as well.

After the learning styles identification process has been accomplished, the next crucial task is for the teacher to be able to use this data to enhance student learning. The Dunn learning styles model has been used in work with many students of various ages and diverse socio-economic and cultural backgrounds over the past fifteen years. The Dunns have identified specific learning style characteristics of students and have then worked with various instructional approaches and different types of learning materials, along with adapting the physical setting to accommodate the learning preferences of students. The data from their research indicate a significant level of success in assisting students to increase their academic achievement levels.

It would be unrealistic to expect a teacher to be able to accommodate all of the learning preferences of all the students in a typical class of 25-30 students. This is neither possible nor necessary. All people need to be adaptable in both the school and out-of-school environments. However, there are some ways that teachers can adapt to students' learning preferences that can result in students learning more effectively, with the accompanying enhanced sense of satisfaction with school and the school environment.

The Dunn model suggests a number of ways that teachers can accommodate students' learning preferences (Dunn and Dunn, 1978). In regard to the environmental elements that affect learning,

teachers can oftentimes accommodate students' temperature, sound, and light preferences by changing the arrangement of the classroom so that students who prefer quiet can work in the more quiet areas of the room, those who want the brightest light can be seated accordingly, and the differing temperature conditions of the room can be considered in regard to students' individual preferences. Students' emotional, sociological, physical, and psychological needs can also be accommodated by rearranging the classroom to provide for the varied learning styles, and this can be done at both the elementary and the secondary grade levels. The classroom does need to be large enough to provide room for some different areas and have desks or tables and chairs that are movable. A teacher can then plan places in the classroom where several students may get together to discuss what they are learning, locate and use the areas of the room that are best lighted, utilize the warmer and cooler portions of the classroom for the students who have decided temperature preferences, provide sections of the room that permit close supervision of less responsible students, utilize dividers or bookcases to create a quiet area for those students who sometimes need this environment, and perhaps even provide an area where snacking is allowed (preferably raw vegetables, fruits, nuts, and other nutritious foods).

Learning materials and the manner in which they are structured can also assist teachers in accommodating students' learning preferences. For example, the motivated, persistent student who

likes structure and does not mind working alone could use programmed learning materials to advantage. Programmed learning, along with any type of instructional package materials, is not as likely to be successful for the unmotivated student who lacks patience and persistence. Neither is programmed learning as interesting for the student who likes to work with others, either peers or an adult. However, task cards and learning circle and learning games type activities usually work well with students who enjoy working with other students or the teacher. Students who are auditory learners can utilize tapes and audio cassettes to advantage. The benefits gained from accommodating the learning preferences of auditory as well as visual learners is evident when results of research indicate an auditory learner can remember about 75 percent of what is verbalized in a 40-45 minutes lecture, while a visual learner remembers approximately 75 percent of what is seen during a class period of the same length (Dunn, 1981).

Chronobiology is a relatively new area of science that is providing scientific verification that each person enjoys different peak energy times during the day or night. Even though people have been informally aware of differing energy peaks, chronobiology research findings have implications for classroom instruction. Research data have verified that teaching math the first thing each morning is not necessarily the ideal time for all students to learn math. The same principle applies to teaching reading or any learning endeavor.

Other physical elements are also factors in learning and can be accommodated within the learning environment. The need for mobility generally is essential for kindergarten children who tend to be strong tactual/kinesthetic. However, even at the kindergarten age level, students vary in their need for mobility. Generally, students have less need for mobility as they become older, but even at the secondary level, some students are just not able to sit still for a sustained period of time, especially at some times of the day. Classroom activities that allow for movement and some large-scale motor activities will be more effective with such students than are learning activities that require totally sedentary status.

A psychological factor that the teacher can accommodate is the consideration of the student's hemispheric preference, sometimes referred to as right brain or left brain preference. Both sides of the brain are utilized by all people in learning, unless some abnormality or accident has destroyed a major segment of the brain; however, many people tend to have right brain or left brain tendencies. The person who has left brain tendencies may prefer to learn through an analytical approach; whereas, the person with right brain tendencies may prefer a global approach to instruction. Likewise, some students, usually those with left brain dominance, tend to be very time oriented. Being on time is important to these students, and they can accomplish this fairly easily and consistently. This may not be as easy for the student who is neither as interested in and therefore as

concerned about time. According to researchers, the left hemisphere of the brain shows a distinct advantage when it comes to analytic tasks like dealing with language or classifying objects, while the right hemisphere seems more important in performing spatial tasks. Some researchers have linked environmental elements such as sound, light, and temperature as correlating with hemispheric inclinations.

Matching the student's learning style to the teacher's instructional style is also beneficial. Obviously, this is not possible unless the school is large enough so that there is more than one teacher in a building for each grade level in the elementary school and more than one teacher teaching a specific subject at the secondary level. Research has verified that the closer the match between the student's and teacher's styles, the higher the grade point average and the more the student likes school (Dunn, 1981).

Because the study of learning styles and the effect of differing learning styles on educational achievement is a relatively new research endeavor, much is still unknown. The research efforts of Rita and Kenneth Dunn, along with others, has provided a good beginning to assist teachers to enable students to make greater educational gains within educational environments that are more favorable to students' individual learning preferences.

References

- Dunn, R. A learning styles primer. Principal, 1981, 65 (May), 31-34.
- Dunn, R. and Dunn, K. Teaching students through their individual learning styles, a practical approach. Reston, Virginia: Reston Publishing Company, Inc., 1978.
- Dunn, R., Dunn, K., and Price, G. Learning styles inventory. Lawrence, Kansas: Price System, Inc., 1978.
- National Association of Secondary Principals. Student learning styles and brain behavior. Reston, Virginia: Author, 1982.

Appendix A

TITLES OF PRESENTATIONS AND PRESENTERS

Keynote Session

Darrell Jensen, Dean
Division of Education
South Dakota State University

Using the Transactional Ability Inventory

Chuck Lingren
Division of Education
South Dakota State University

How the Brain Works: The Proster Theory of Learning

Tom Reifschneider
Division of Education
South Dakota State University

Cognitive Style Mapping

Connie Bohns
Lead/Senior SRI
Special Intermediate School District #916
916 Area Vocational Institute
White Bear Lake, MN

Microcomputers and Individual Learning Styles

Carl Edeburn
Division of Education
South Dakota State University

Structure of Intellect in Education

Bob Ristow
Division of Education
South Dakota State University

Understanding Psychomotor Learning Processes: A Systematic
Approach for Teaching Physical Education

Fred Oien
Health and Physical Education Department
South Dakota State University

Approach to Teaching Students Through Their Individual Learning
Styles -- Dunn & Dunn

Lois Widvey
Division of Education
South Dakota State University

Reading Literary Texts: A Whole Brain Affair
Gary Steinley
Division of Education
South Dakota State University

Poems Take Two Brains (Or: Poetry Ain't for Half-Wits)
Jack Kreitzer
Consultant for Gifted Programs
Black Hills Special Services Cooperative

Piaget Assists School Science
Marv Selnes
Sioux Falls School District

Bloom by any Other Name is Still Bloom
Joan Dunmire
Resource Teacher
Francise Case School
Douglas School System

Learning Spurts and Plateaus: An Awareness Session
Bob Rose
Elementary Principal
Hot Springs School District

The Flesh Colored Band-Aid: Cultural Differences in the Classroom
Ronnie Theis
Black Hills State College

Adapting Media for Individual Learning Styles
Dee Ann Fine
Division of Education
South Dakota State University

Art in the Classroom: Right Brain Strategies
Darla Guisinger
Rapid City Public School District

Appendix B

A Short, Concise, yet Thoroughly Conclusive
Study of
Joint Affiliation/Rejection Grouping Operant Knowledge
(JARGON)
as described in a presentation to the
Brookings Regional Assembly Investigating Neuronic Sympatics
(BRAINS)
of
South Dakota State University
(SODS)

DARRELL LEDGER
Lake Benton Schools
Lake Benton, Minnesota

(Editor's Note: The following paper was not presented at the conference, but was written by a graduate student after a class discussion following the conference. The class had complained about the widespread use of jargon by learning theorists. A word of explanation about a couple of the references--D.R. Tom is a play on the course instructor's name and Walker was another student in the class who like the author is a music teacher.)

The following is an exerpt of a speech given by M.A.D.Dr. Ledger to the BRAINS of SODS, November 17, 1982.

Good evening, tonight I will present to you my theory of learning. So that all present might be cognizant of my authority, I wish to offer my credentials. In my professional and social circles, (of whom at present I am the only member), I am widely regarded as the most intelligent person in Lake Benton, Minnesota.

I am referred to as Mr. Education. I understand that some of my admirers have composed a quaint tribute to me. When asked by someone a question requiring great knowledge and perception, a person in Lake Benton will sing this little jingle: "Talk to Mr. Ed."

Widely bandied about is the theory of a holographic, or three dimensional, image of the brain. I, however, prefer a concept much more comprehensible and observable. I refer, of course, to the two dimensional Cubic model.

Let us take an overview, however brief, then study each topic in detail. My theory is called:

Joint Affiliation/Rejection Grouping Operant Knowledge, or to make a universally applicable acronym, JARGON.

Use of JARGON, I believe, is the preeminent way of describing learning in today's technocratic society. Without JARGON there would be no clear, precise understanding of what I, or for that matter, any other serious student of learning means. JARGON is a theory that eliminates the need for ambiguous, superfluous, educationally nonrigorous vocabulary, which is fraught with

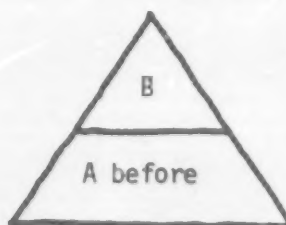
illimitable possibilities for misunderstanding or misapplication, especially by those not grounded in depth in philosophical, philological, or psychological nuances, practices, and/or terminologies. Such possibilities are the basis for much of what is inappropriately, egregiously, seen as unclear, not clear, half clear, partly clear or partly cloudy from the perspective of non-expert observers expecting an obvious answer to what, we who are enlightened, comprehend as unbounded opportunity in comparative classification of facilitating factors, otherwise known to the uniformed as "Behavior" (Faeker, 1981).

Use of JARGON prevents exactly this. We, and of course, I include the illuminaries here present at this hour, are expert practitioners, having refined this noble theory to its present universal catholicity, though some protestants still prefer the imprecise patter presumed by cognoscenti to be inoperant in most discriminating patios.

Let us now explore the facets of JARGON.

By Joint, I refer to the manifold possibilities of interpretation present. Many older theories took as given a pyramidal concept of learning where a base of knowledge/information/experience was necessarily established and above which then a superstructure of learning is raised. See Figure 1 (Cheops, 1980 BC).

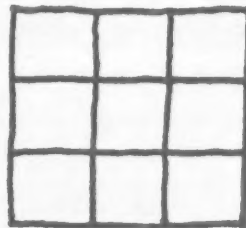
Figure 1.



Without such a base, higher functions or more difficult learning would be impossible. This would be described in obsolescent terminology as "Empirical Learning."

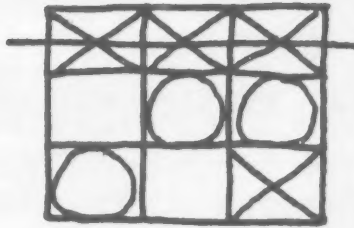
My new, proven theory has as its model not a pyramidal, but a two dimensional cube (Rubik, 1978). No base is needed, rather manipulation of many variables may create the necessary logical base from which cognitive operations may be carried out. See Figure 2.

Figure 2.



The second and third parts of JARGON are Affiliation/Rejection. This ties in with the concept of Cubic learning. As information is arranged by the learner in the two dimensional cubic operation, various disagreements, inconsistencies, deviations, incongruities and balderdash arise which prevent assimilation or execution of the desired concept. Affiliation is the strategy where material conducive to the momentarily appropriate action is matched. Rejection is the process by which material, though perhaps relevant, concrete, and even correct, is rejected in favor of items more opportune. A visual explanation occurs in Figure 3 (A. Maze, 1982).

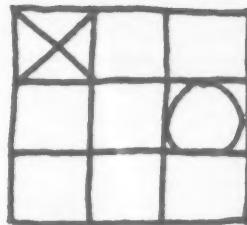
a. desired perception:



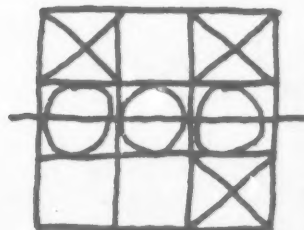
b. actual state of mind:

c. process of JARGON:

A.

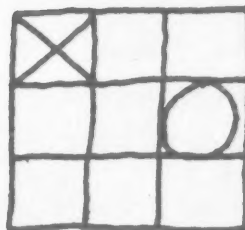


B.



*% "#&!!!!

C.



D.

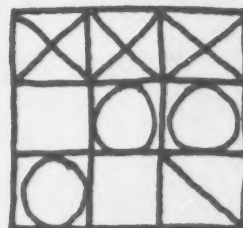


Figure 3 (D.R. Tom, 1980).

All this, naturally, occurs in an instant, which is a JARGON Transformation.

Now should information occur which indicates an inappropriateness of one or more agglomerations, the Rejection takes place, removing the bit or bite not in conformity to the larger scale* moment's expectations. It is easy to understand the reasons for the widespread popularity of JARGON theory in psychological studies.

The action of Affiliation/Rejection is quite obviously entitled Grouping, and that which results is termed Operant Knowledge. Operant Knowledge is nowing how to operate. Q.E.D. (M. Chomster, 1980).

Once JARGON has occurred, JARGON will necessarily increase. Our Theory holds that enough practice of JARGON leads to PREcise OSTEnsible ReactionS, which may for ease of understanding, and herein are, termed PROSTERS.

*Most modern neuronauts use the eight step DODO Scale, to wit; DOgmatic; REalistic; MIdiocre; FAIlacious; SOLudicrous; LAughable; Tirrible; Domb (Walker, 1982).

These PROSTERS are sensitive to maladaptation, because of the intricacies of the JARGON process (c.v.). An errant ingot of misinformation may become lodged as permanent, leading to IMPRecise OSTEnsible ReactionS, called IMPROSTERS.

Fortunately, research has shown that other PROSTERS will become aware of IMPROSTERS, and sound a warning. An appropriate image should be that of a whistle being blown. Thus, it is that IMPROSTERS would be given away by PROSTER toots.

The sensation occasioned by having PROSTER toots is, by all accounts, quite shocking. The name most often given to this process is JARGON shock.

JARGON shock has proved its use repeatedly throughout society. One hears almost daily of successful cases.

Our theory, then is obvious, easily understood, and acclaimed as the ultimate idea in psychology. I think that its application to education and knowledge is apparent:

STUDYING IS NO LONGER NECESSARY TO OBTAIN DESIRED ACTIONS
(read learning)

Holding that JARGON theory is valid (and it has been reliably reported so) the variables in the two dimensional cubic model of the brain would reach unmanageable proportions should study of materials be admitted into consideration.

Such proliferation of cubic references would by its own number render JARGON specious and obstruct PROSTERS and construct IMPROSTERS. Succinctly put, the logic of the following amply demonstrates this conclusion:

The more one studies,
The more one nows,
The more one nows,
The more one forgets,
The more one forgets,
The less one nows,
Thus, why study?

Further research into this theory is encouraged, and copies of your results appreciated. Please send any materials, printed in block letters, on 3 x 5" cards, one side only, to:

The Skinner/Chomsky Cooperative Institute
1010101 I. Fell Tower
Paris, Texas
07734-7734

I thank you most humbly for allowing me to broaden your bounds of nowledge.